DOCKET NO: 273286US0PCT

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
HIROSHI SUGITATSU, ET AL.	: EXAMINER: MCNELIS, K. A.
SERIAL NO: 10/541,457	:
FILED: JULY 6, 2005	: GROUP ART UNIT: 1742
RCE FILED: SEPTEMBER 7, 2007	
FOR: METHOD FOR REDUCING CHROMIUM CONTAINING RAW MATERIAL	:

APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

This is an appeal of the Rejection dated September 27, 2007 of twice-rejected Claims 1 and 3-8. A Notice of Appeal, along with a two-month extension of time, was timely filed on February 27, 2008.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Kobe Steel, Ltd., having an address at 10-26, Wakinohama-cho, 2-chome, Chuo-ku, Kobe-shi, Hyogo, Japan, 651-8585.

II. RELATED APPEALS AND INTERFERENCES

Appellants, Appellants' legal representative and the assignee are aware of no appeals, interferences, or judicial proceedings which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF THE CLAIMS

Claims 1 and 3-8 stand rejected and are herein appealed. Claims 2 and 9-11 have been canceled.

IV. STATUS OF THE AMENDMENTS

No amendment under 37 CFR 1.116 has been filed.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

A summary of the claimed subject matter, as claimed in sole independent Claim 1, is mapped out below, with reference to page and line numbers in the specification added in **[bold]** after each element.

The claimed subject matter is a method for reducing a chromium-containing material, comprising a mixing step of mixing a chromium-containing material comprising chromium oxide and iron oxide and a carbonaceous reductant to provide a mixture; and a reducing step of heating, and reducing the mixture with a rapid temperature rise by radiation heating in a moving hearth furnace to provide a reduced mixture, **[page 5, 3rd paragraph]** wherein the average rate of raising the temperature of the mixture in the reducing step is 13.96°C/s or higher in the period from the initiation of the radiation heating of the mixture until the mixture reaches 1,114°C. **[paragraph bridging pages 27 and 28, as amended by amendment filed September 7, 2007]**

VI. GROUNDS OF REJECTION

Ground (A)

Claims 1 and 7 stand rejected under 35 U.S.C. § 103(a) as unpatentable over US 5,567,224 (Kundrat), or US 6,592,649 (Kikuchi et al) or US 6,755,888 (Ibaraki et al) alone or

in view of US 6,270,552 (Takeda et al), and further in view of US 5,730,775 (Meissner et al) and *Perry's Chemical Engineers' Handbook* (Perry).

Ground (B)

Claims 3, 4 and 8 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kundrat or Kikuchi et al in view of Meissner et al and Perry.

Ground (C)

Claims 5 and 6 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kikuchi et al in view of Meissner et al and Perry.

VII. ARGUMENT

Ground (A)

Claims 1 and 7 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kundrat, or Kikuchi et al or Ibaraki et al alone or in view of Takeda et al, and further in view of Meissner et al and Perry. That rejection is untenable and should not be sustained.

As described in the specification under "Background Art," beginning at page 1, second paragraph, it is well-known in the art to reduce chromium oxide-iron oxide mixtures in the presence of a carbonaceous material. However, such reductions have been problematical for various reasons, including the fact that iron oxide undergoes reduction by carbon at a lower temperature, and thus earlier than corresponding reduction of chromium oxide, thereby leaving insufficient carbonaceous material to achieve a desired chromium reduction degree. Increasing the amount of carbonaceous material to overcome this problem results in other problems.

Applicants address the above-discussed problem with the present invention. As recited in Claim 1, an embodiment of the present invention is a method for reducing a chromium-containing material, comprising a mixing step of mixing a chromium-containing material comprising chromium oxide and iron oxide and a carbonaceous reductant to provide a mixture; and a reducing step of heating, and reducing the mixture with a rapid temperature rise by radiation heating in a moving hearth furnace to provide a reduced mixture, **wherein the average rate of raising the temperature of the mixture in the reducing step is 13.96°C/s or higher in the period from the initiation of the radiation heating of the mixture until the mixture reaches 1,114°C**.

(Emphasis added.)

Applicants are thus able to increase the chromium reduction degree with the presently-recited rapid temperature rise by radiation heating, which is neither disclosed nor suggested by the prior art.

Kundrat, Kikuchi et al, Ibaraki et al and Takeda et al are all drawn to reducing metal oxides in rotary hearth furnaces using a carbonaceous material. However, none of these references discloses anything about the above-discussed problem, or Applicants' solution thereto which, as recited above, involves raising the temperature of the mixture in the reducing step at a particular minimum speed in the period from the initiation of the radiation heating of the mixture until the mixture reaches 1,114°C, which is the temperature at which the reduction of chromium oxide starts according to reaction formula (2), as described in the specification at page 14, first through third full paragraphs. Note further the definition of "initiation of the radiation heating" at the paragraph bridging pages 14 and 15 of the specification.

To cure the above-discussed deficiencies of the above-discussed prior art, the Examiner relies on Meissner et al and Perry. Meissner et al is drawn to a method and

apparatus for producing direct reduced iron from dry compacts composed of iron oxide and carbonaceous material by feeding compacts no more than two layer deep onto a hearth and removing all the volatiles and metallizing the compacts by exposing the compacts to a radiant heat source at a temperature of from about 1316-1427°C for a total time period of about four to ten minutes and partially cooling the compacts while discharging them from the hearth (Abstract). Meissner et al discloses prior art in which such direct reduction was carried out at lower temperatures to dry and devolatilize pellets in order to avoid pellet exfoliation but that this method is disadvantageous in that it decreases productivity due to the long time required for pellets to reach optimum reduction temperature (column 1, lines 11-19). Meissner et al's discovery was that the pellets could be exposed immediately to a radiant heat source in the above-discussed temperature range without causing exfoliation and thereby obtain increased productivity (column 3, lines 18-33).

The Examiner relies on Perry for a finding that the rate of radiant heat transfer in a furnace is strongly affected by temperature.

The Examiner relies on Meissner et al to find that "the temperature of the radiant heat transfer source is a result effective variable which is varied to affect the time required to achieve metallization goals," and in view of Perry, therefore finds that it would have been obvious "to adjust the radiant heat source temperature as a result-effective variable in the process of Kundrat or Kikuchi et al or Ibaraki et al alone or in view of Takeda et al, therefore adjusting the rate of heating to affect the time required to achieve metallization goals as taught by Meissner et al."

In reply, and as supported by the Declaration under 37 CFR 1.132 of Takao Harada (Harada Declaration), the method and apparatus of Meissner et al has nothing to do with reduction of chromium-containing materials and thus cannot possibly shed any light on the above-discussed problems which the present invention addresses, which include iron oxide

reduction by carbon at low temperatures, and thus earlier than corresponding reduction of chromium oxide, thereby leaving insufficient carbonaceous material to achieve a desired chromium reduction degree, and that increasing the amount of carbonaceous material to overcome this problem results in other problems.

Moreover, the presently-recited rapid temperature rise limitation of the present claims is not simply rapid heating but rather raising the temperature at a particular minimum rate and for a particular period, ending at a particular end temperature, which coincides with the temperature at which the reduction of chromium oxide starts. Absent the present disclosure as a guide, there would have been no reason for one of ordinary skill in the art to combine Meissner et al and Perry with the remaining prior art, and if combined, the result would still not have been the presently-claimed invention.

The Examiner has relied on Meissner et al and Perry to support a finding that the above-emphasized limitation is a result-effective variable, although the Examiner has not shown that the prior art was aware that the above-emphasized limitation, i.e., the average rate of temperature rise for reducing a chromium-containing material in a particular temperature range, is a result-effective variable. Indeed, Harada declares in the Harada Declaration that it was not a known result-effective variable. Thus, the present claims are patentable under the rationale of *In re Antonie*, 559 F.2d 618, 195 USPQ 6, 8-9 (CCPA 1977) (exceptions to rule that optimization of a result-effective variable is obvious, such as where the results of optimizing the variable are unexpectedly good or where the variable was not recognized to be result effective). Applicants are entitled to prevail under at least the second of the above exceptions.

The following is a reply to the Examiner's response, at pages 6-7 of the rejection, to the above arguments.

The Examiner finds that the Harada Declaration does not provide evidence of criticality with regard to the recited heating rate of 13.96°C/sec.

In reply, the purpose of the Harada Declaration was not to show such criticality, but to support Applicants' argument that Perry and Meissner et al are essentially irrelevant herein, and that the above-emphasized limitation from Claim 1 was not a known result-effective variable at the time the presently-claimed invention was made.

With regard to the heating rate in the claims of at least 13.96°C/sec., Applicants explain the reason for this heating rate in the specification at the paragraph bridging pages 27 and 28, as amended by the amendment filed September 7, 2007. As described therein, that rate is based on the time it takes the Fe metallization degree to reach 50% and the difference in temperature between an initial temperature and the temperature at which reduction of chromium oxide starts.

The Examiner states that each of Kundrat, Kikuchi et al, and Ibaraki et al disclose reducing a mixture of iron and chromium oxides, and that each of these references is in the same field of endeavor as the present invention, as is Meissner et al.

In reply, none of the applied prior art discloses anything about the problems addressed by the presently-claimed invention, or Applicants' solution thereto, as discussed above. Indeed, Applicants do not profess to be the first to attempt to reduce a mixture containing chromium oxide and iron oxide with a carbonaceous reductant, as acknowledged in the specification under "Background Art" beginning at page 1, second paragraph.

The Examiner finds that Kundrat discloses heating to at least 1,000°C, preferably 1200°C; that Kikuchi et al discloses heating rapidly to 1100°C; and that Ibaraki et al discloses heating quickly to 1100 to 1300°C, and concludes that each of these references "teaches heating to the approximate endpoint in the instant claims."

In reply, it is only happenstance that these references disclose heating to temperatures that the Examiner finds is "the approximate endpoint" of the presently-recited 1114°C. Their reasons for heating to the above temperatures are different from Applicants' reasons. More specifically, the temperatures disclosed by these references are not suggestive of 1114°C which, as discussed above, is the temperature at which the reduction of chromium oxide starts. For this reason alone, the presently-claimed invention is patentable.

The Examiner finds that Meissner et al "teaches the benefit of rapid heating to more quickly reach metallization goals and thus improve productivity."

In reply, this vague finding does not address the specifics of the presently-claimed invention.

Similarly, while the Examiner acknowledges that the claims recite a heating rate, the Examiner's finding that Meissner et al "teaches the use of a higher temperature to increase productivity" and that Perry "is cited as evidence that a higher temperature results in a higher heating rate" are again vague findings that do not address the specifics of the presently-claimed invention.

The Examiner finds that the relevance of the argument regarding US 6,152,983 (Kamijo et al), is not clear.

In reply, Kamijo et al was cited in the Harada Declaration at paragraph 8 therein simply to contrast the heating rate and temperature range therein from that of the present claims.

For all the above reasons, it is respectfully requested that this rejection be REVERSED.

Ground (B)

Claims 3, 4 and 8 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kundrat or Kikuchi et al in view of Meissner et al and Perry. That rejection is untenable and should not be sustained.

The disclosures and deficiencies of the above prior art have been discussed above under Ground (A) , which are hereby incorporated by reference. In addition, for Claims 3 and 8, the specification herein contains data comparing reduction at 1,200°C, as shown in Fig. 3, and reduction at 1,300°C, as shown in Fig. 4, and as described for Example 1, beginning in the specification at page 24, second full paragraph. By comparing Figs. 3 and 4, it can be ascertained that for a particular residence time, the chromium reduction degree is significantly greater at the higher temperature but at a relatively constant Fe metallization degree. These results could not have been predicted by the applied prior art.

For all the above reasons, it is respectfully requested that this rejection be REVERSED.

Ground (C)

Claims 5 and 6 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kikuchi et al in view of Meissner et al and Perry. That rejection is untenable and should not be sustained.

The disclosures and deficiencies of the above prior art have been discussed above under Ground (A), which are hereby incorporated by reference.

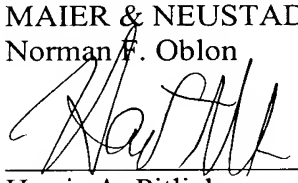
For all the above reasons, it is respectfully requested that this rejection be REVERSED.

VIII. CONCLUSION

For the above reasons, it is respectfully requested that all the rejections still pending in the Rejection be REVERSED.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.
Norman F. Oblon



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CLAIMS APPENDIX

Claim 1: A method for reducing a chromium-containing material, comprising a mixing step of mixing a chromium-containing material comprising chromium oxide and iron oxide and a carbonaceous reductant to provide a mixture; and a reducing step of heating, and reducing the mixture with a rapid temperature rise by radiation heating in a moving hearth furnace to provide a reduced mixture, wherein the average rate of raising the temperature of the mixture in the reducing step is 13.96°C/s or higher in the period from the initiation of the radiation heating of the mixture until the mixture reaches 1,114°C.

Claim 3: The method for reducing a chromium-containing material according to Claim 1, wherein the reducing step is performed at 1,250°C to 1,400°C.

Claim 4: The method for reducing a chromium-containing material according to Claim 1, further comprising a reducing and melting step of melting the reduced mixture provided in the reducing step by successive radiation heating to provide a reduced molten material.

Claim 5: The method for reducing a chromium-containing material according to Claim 4, further comprising a solidifying step of cooling and solidifying the reduced molten material provided in the reducing and melting step in the moving hearth furnace to provide a reduced solid; and a separating step of separating the reduced solid into metal and slag.

Claim 6: The method for reducing a chromium-containing material according to Claim 4, wherein the reducing step is performed at 1,250°C to 1,400°C; and the reducing and

melting step is performed at a temperature higher than that in the reducing step within the range of 1,350°C to 1,700°C.

Claim 7: The method for reducing a chromium-containing material according to Claim 1, wherein a carbonaceous atmosphere-adjusting agent is charged together with the mixture onto the hearth of the moving hearth furnace in the reducing step.

Claim 8: The method for reducing a chromium-containing material according to Claim 1, wherein the reducing step is performed at 1,300°C to 1,400°C.

EVIDENCE APPENDIX

Declaration under 37 CFR 1.132 of Takao Harada (Harada Declaration), filed September 7, 2007.

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FOR: METHOD FOR REDUCING CHROMIUM CONTAINING RAW MATERIAL	:

DECLARATION UNDER 37 C.F.R. § 1.132

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

I, Takao Harada, declare and state as follows:

1. I am a named co-inventor in the above-identified application.

2. I am familiar with the claims and the prosecution history in the above-identified application.

3. A rationale of the Examiner for concluding that the claims are unpatentable is her finding that **carrying out the reducing step at an average rate of raising the temperature of the mixture of 13.6°C/s [now corrected to 13.96°C/s] or higher in the period from the initiation of the radiation heating of the mixture until the mixture reaches 1114°C** in the method for reducing a chromium-containing material of the invention claimed in the above-identified application, is a result-effective variable which would have been obvious to optimize, and thus does not establish patentability of the claimed subject matter.

(Emphasis added.)

4. In support of finding that the above-emphasized limitation was a known result-effective variable, the Examiner has relied on US 5,730,775 (Meissner et al) and *Perry's Chemical Engineers' Handbook* (Perry).

5. Perry has been relied on for a finding that the rate of radiant heat transfer in a furnace is strongly affected by temperature.

6. Meissner et al has been relied on for a finding that "the temperature of the radiant heat transfer source is a result effective variable which is varied to affect the time required to achieve metallization goals."

7. The method and apparatus of Meissner et al has nothing to do with reduction of chromium-containing materials and thus cannot possibly shed any light on the problems which the present invention addresses. Thus, while it is well-known in the art to reduce chromium oxide-iron oxide mixtures in the presence of a carbonaceous material, such reductions have been problematical for various reasons, including the fact that iron oxide undergoes reduction by carbon at a lower temperature, and thus earlier than corresponding reduction of chromium oxide, thereby leaving insufficient carbonaceous material to achieve a desired chromium reduction degree. Increasing the amount of carbonaceous material to overcome this problem results in other problems. The above-emphasized limitation of the present claims is not simply rapid heating but rather raising the temperature at a particular minimum rate and for a particular period, ending at a particular end temperature, which coincides with the temperature at which the reduction of chromium oxide starts.

8. The above-emphasized limitation was not a known result-effective variable at the time the presently-claimed invention was made. US 6,152,983 (Kamijo et al) which is earlier work of the present Assignee, discloses reduction of pellets including zinc oxide and iron oxide. In Kamijo et al, the pellets are heated at a temperature elevation rate of from 3 to

13°C/sec within a temperature range of from 150 to 900°C. It is unusual to heat pellets rapidly at a temperature elevation rate of 13.96°C/sec or greater within a temperature range of from 25 to 1114°C, as required by the present invention.

9. An object of the present invention is to attain a sufficiently high Cr reduction degree. To that end, the temperature of the pellets has to be raised to at least 1114°C, which is the temperature at which the reduction of chromium oxide starts, by the time the Fe metallization degree reaches 50%.

10. The undersigned declarant declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

11. Further declarant saith not.

Takao Idesaka
Signature

Aug 10, 2007
Date

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RELATED PROCEEDINGS APPENDIX

None.